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Development of Regional Joint Master Program in Maritime Environmental Protection and Management

- MEP&M -

Know-how transfer to teaching staff related to MEP&M

Latest topics on marine and coastal pollution and emission of ghg from shipping, nautical tourism, coastal tourism and off-shore activities (dev.3.4.1)

Sustainable development: from Hippies to Ecosystem Services

Christophe Mocquet, Université Côte d'Azur (UCA-F)

July 25, 2021

Virtual meeting via Zoom application

This project has been funded with support from the European Commission. This presentation reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

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Sustainable development: from Hippies to Ecosystem Services

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- First concepts
- New tools
- Ecosystem services
- Focus on coral reefs

Sustainable development

The concept

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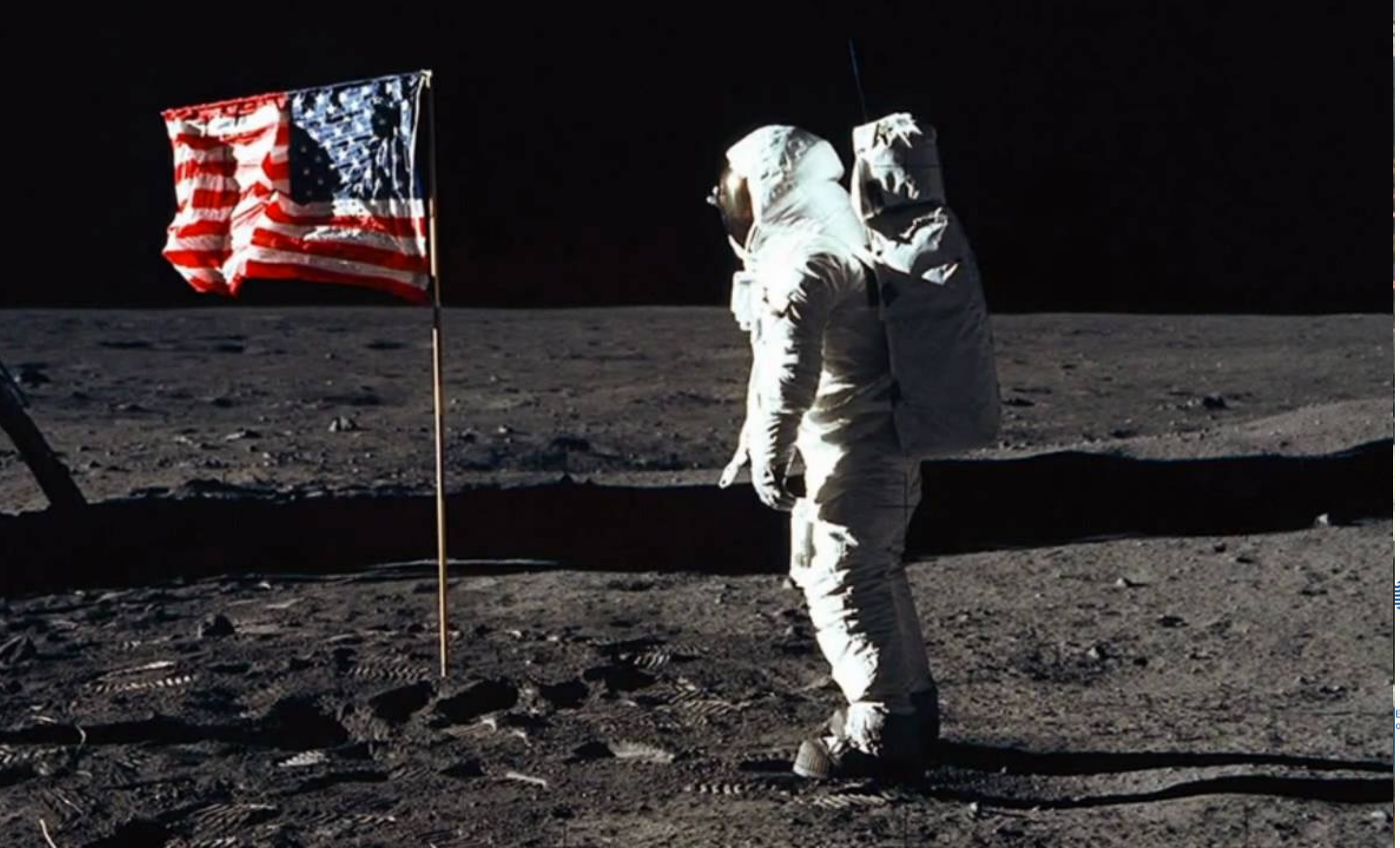

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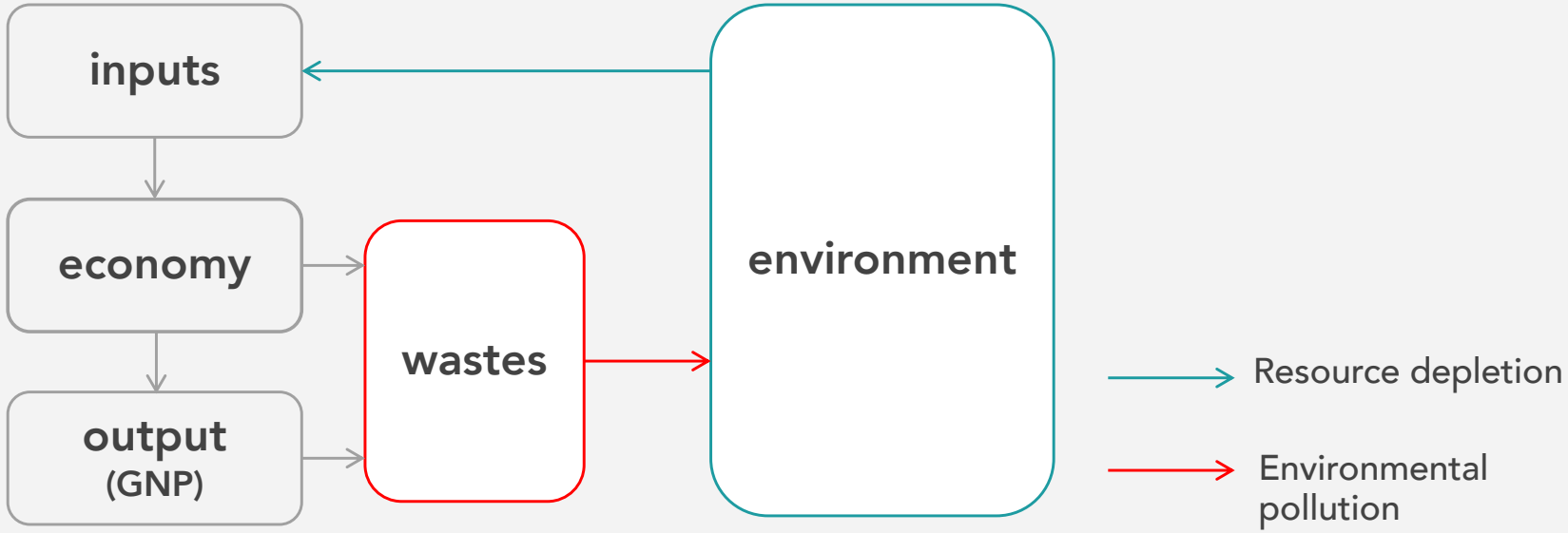
Sustainable development

- **Boulding & the Hippies: the Environment as a Resource**
  - **Economic & Social developments must be placed in their environmental context (Boulding 1960s)**
    - **« Environmental pollution and the depletion of resources are invariably the ancillaries to economic development »**



Adapted from Boulding 1966

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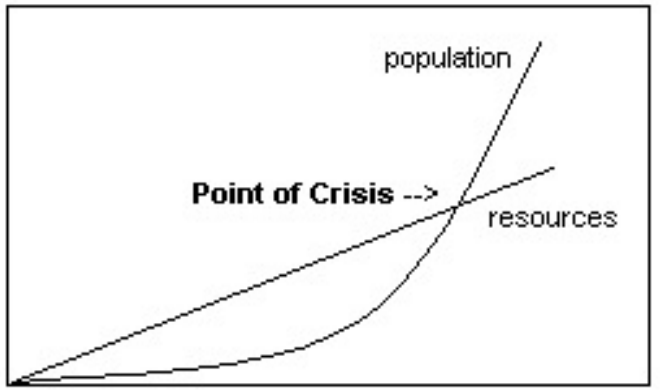
Sustainable development

- First concepts
  - Thomas Malthus 19th century
    - The prevalence of war and disease as secular material phenomena rather than acts of God
    - Human populations are capable of increasing <u>exponentially</u> and would do so as long as sufficient food and other essentials of life are available
    - Problem:

      Food supply increases <u>linearly</u>

      >> point of crisis

      >> conflicts…



Malthus' Basic Theory

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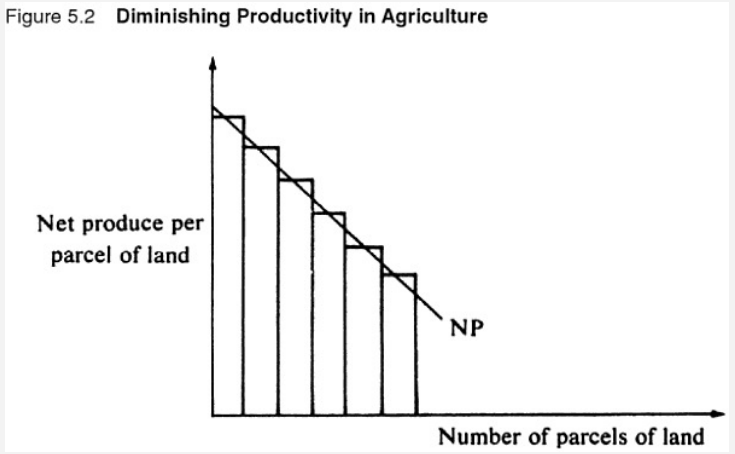
Sustainable development

- First concepts
  - David Ricardo 19th century
    - People would initially farm the land that produces the most food for the least work
    - As population increases, farming would extend to less fertile soils requiring more labor (extensive margin)
    - Consequence:

      Food prices increase

      More intensive use of labor on the better land (intensive margin)



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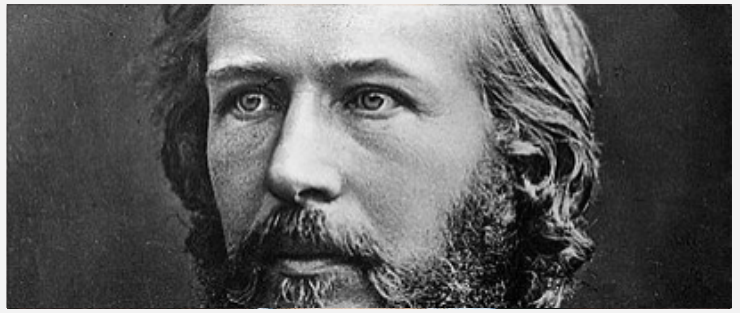
Sustainable development

- First concepts
  - Ernst Haeckel 19th century
    - Ecology = Economy of Nature
    - Investigation of the total relations of the animal both to its inorganic and to its organic environment including above all, its friendly and inimical relations with humans



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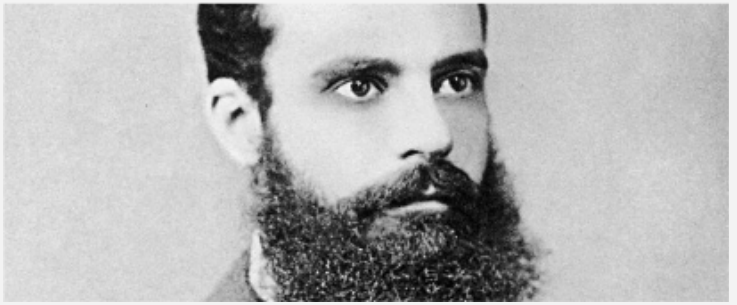
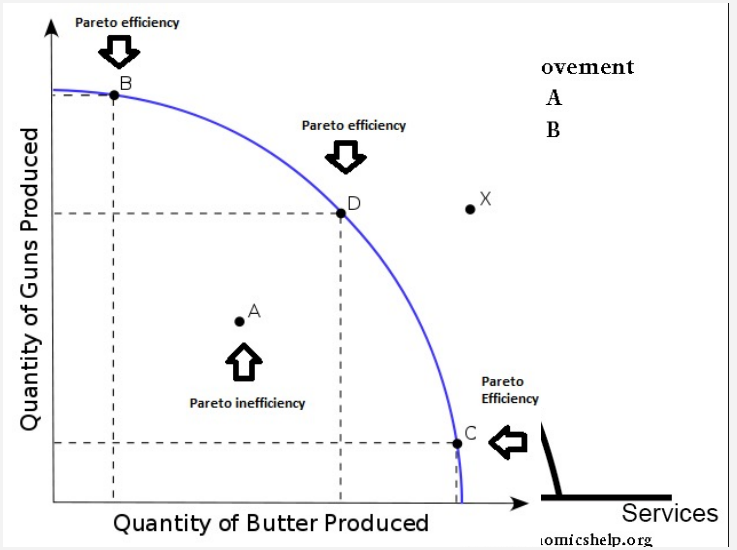
Sustainable development

- First concepts
  - Vilfredo Pareto 19/20th century
    - Well-being criteria of Pareto
    - A situation is Pareto-optimal when one cannot increase the well-being of an agent without reducing that of an other
    - Evaluation of the collective optimality of a given situation





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Sustainable development

- First concepts
  - Arthur Cecil Pigou 20th century
    - Externalities
    - Phenomenon that is external to markets and hence should not affect how markets operate when in fact it should
    - Internalizing a cost that was previously external to the market affects how the market operates

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Sustainable development

- First concepts
  - Arthur Cecil Pigou 20th century
    - Externalities
    - When the actions of an agent influence the well-being of an other agent, without going through a market
    - Not desired, not necessary
    - Can be negative or positive

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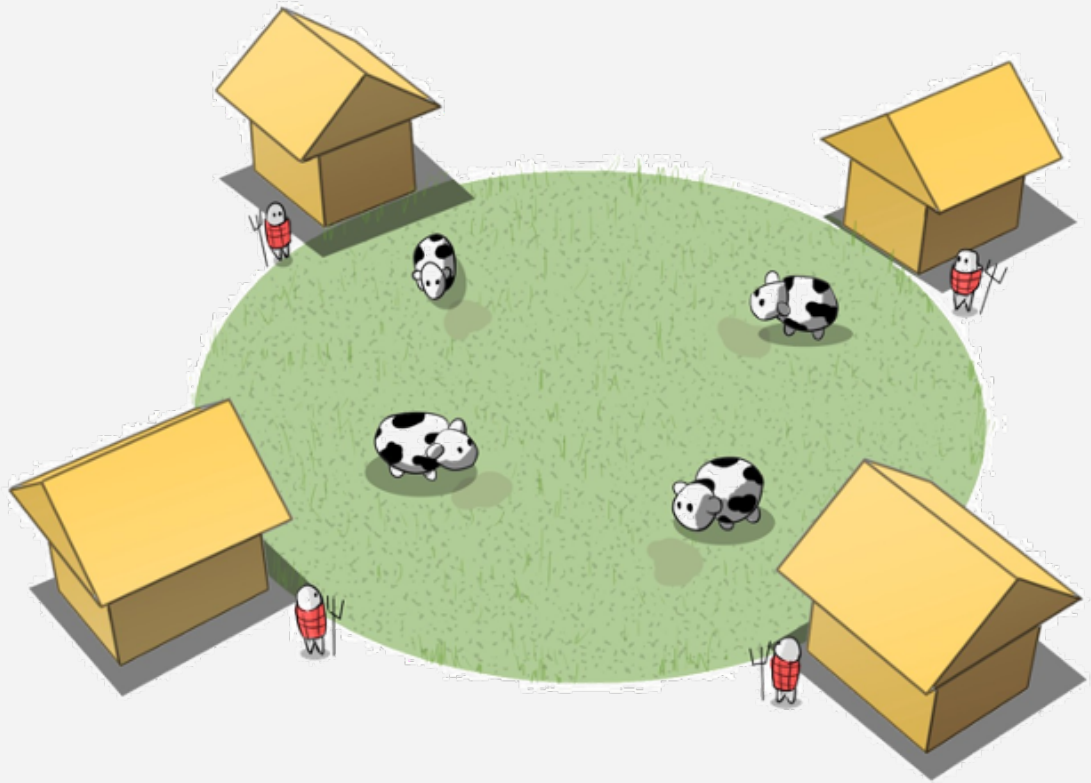
Sustainable development

- First concepts

  - The Tragedy of the Commons Foster Loyd (19th century), Hardin (1960s)

    Example:
    4 milk producers with 1 cow
    Field capaciy: 20/n L/day/cow
    4 cows >> 5L/cow

    If a producer adds a new cow >> 4L/cow
    The other will do the same to compensate
    >> impacts everybody



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Sustainable development

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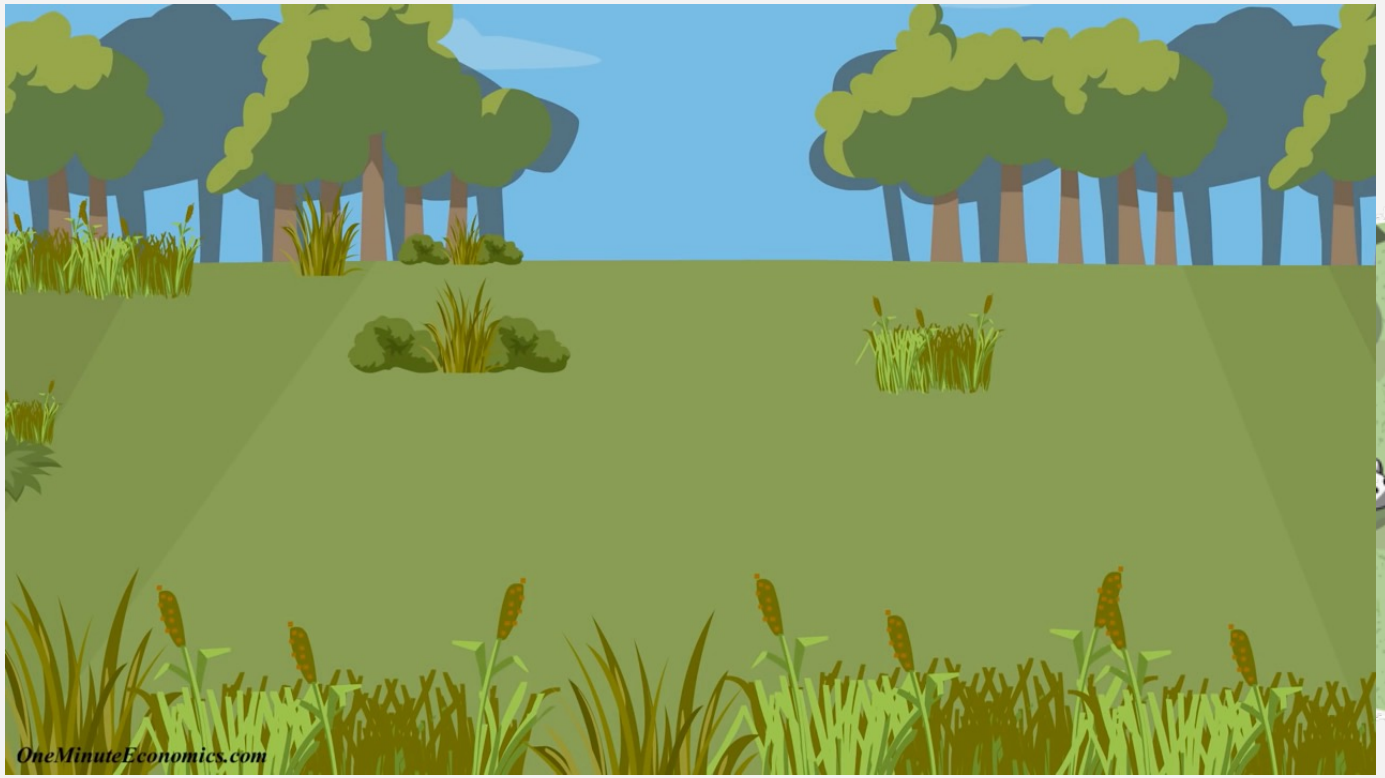

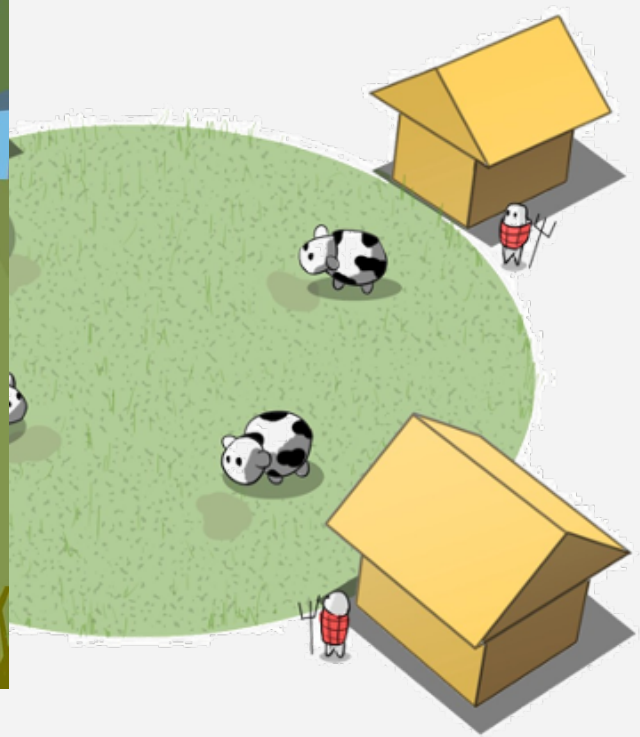

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Sustainable development

New tools

Alamy

SNEMA BBA Introduction to Business [C. Mocquet]
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Sustainable development

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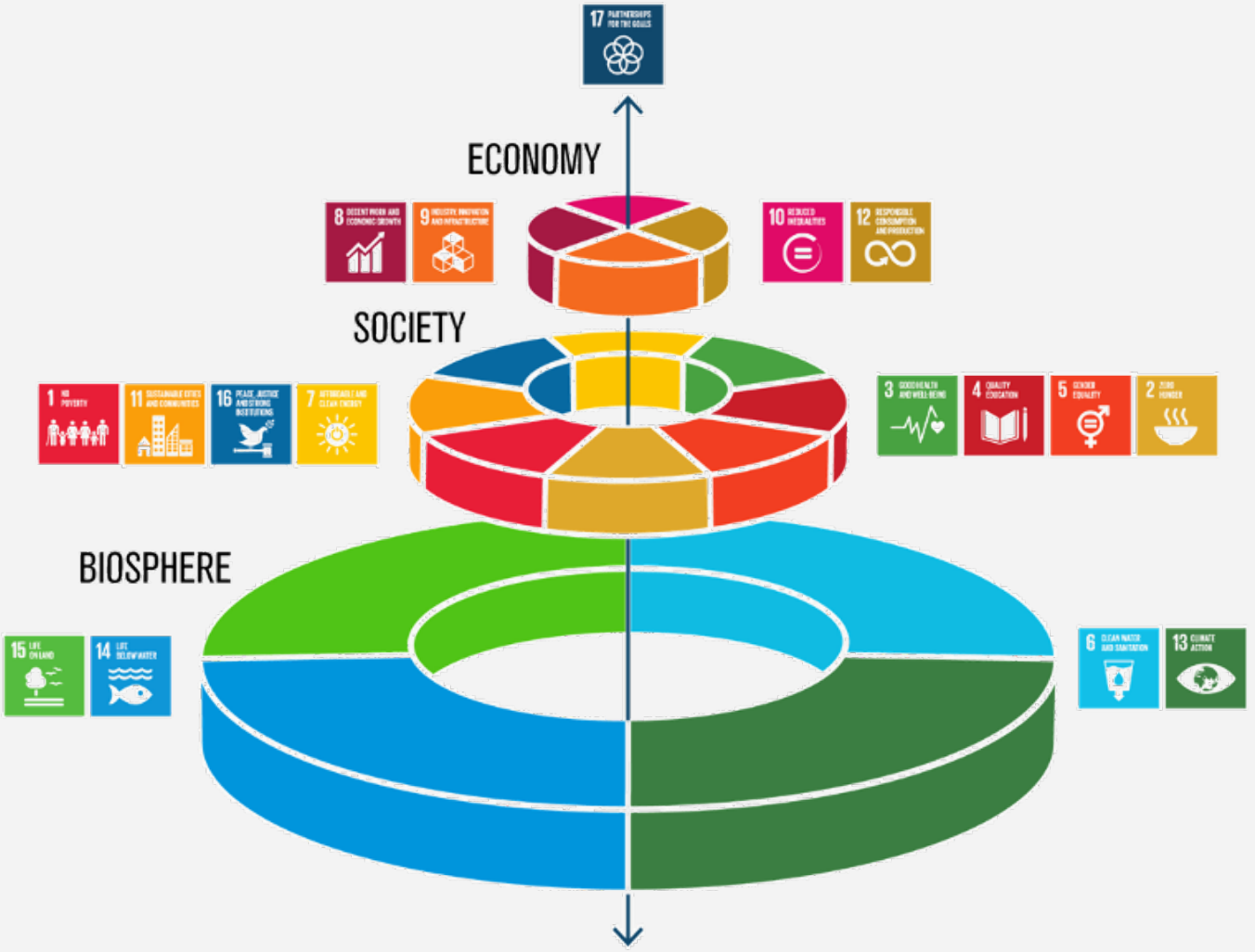
Sustainable development



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Sustainable development

- **Green finance**

= Any financial instrument or investment

equity, debt, grant, purchase & sale or risk management tool

for example: green bound, investment guarantee, insurance product or commodity, credit or interest rate derivative, etc.

issued under contract

to a firm, facility, person, project or agency, public or private

in exchange for the delivery of positive environmental externalities

result in the creation of transferrable property rights

recognised within international, regional, national and sub-national legal frameworks.

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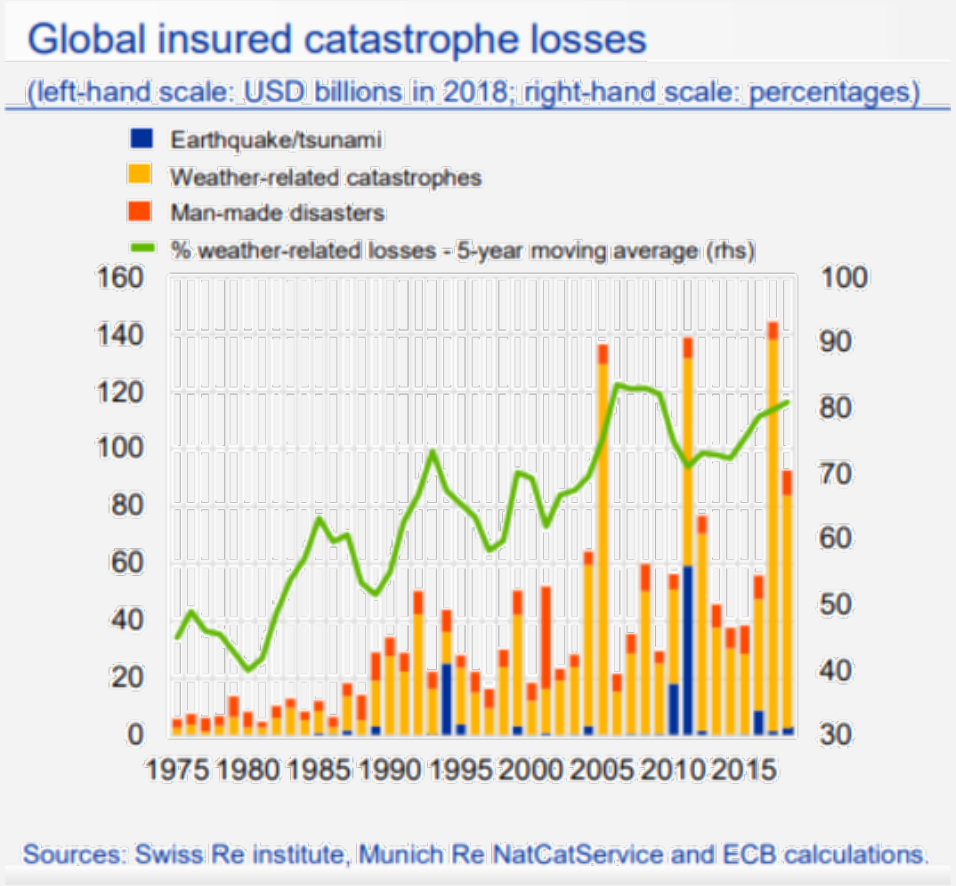
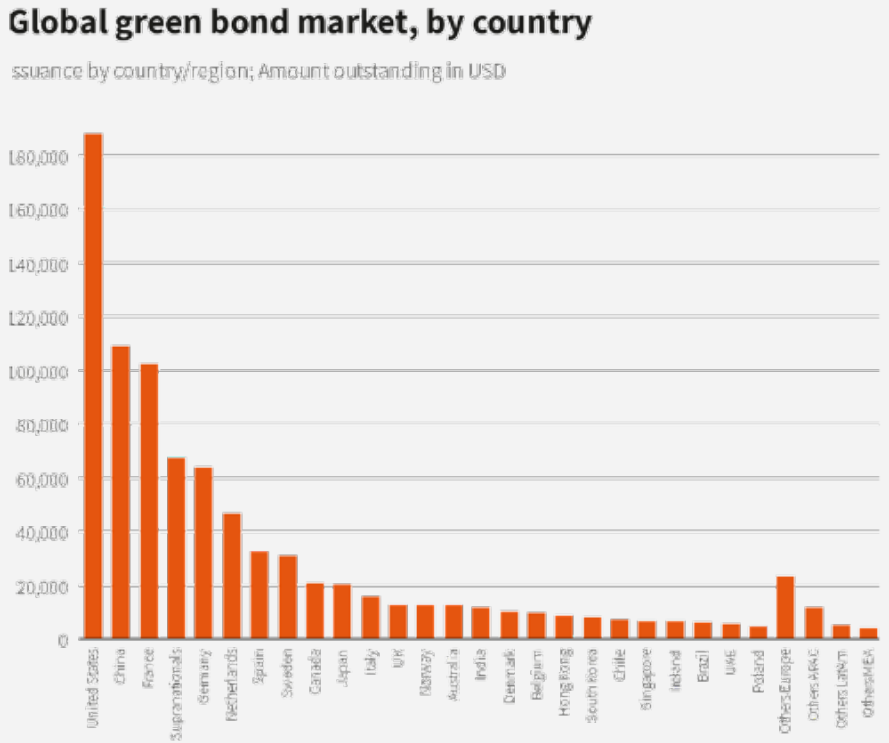
Sustainable development

- **Green finance**





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Sustainable development

- **Green finance**

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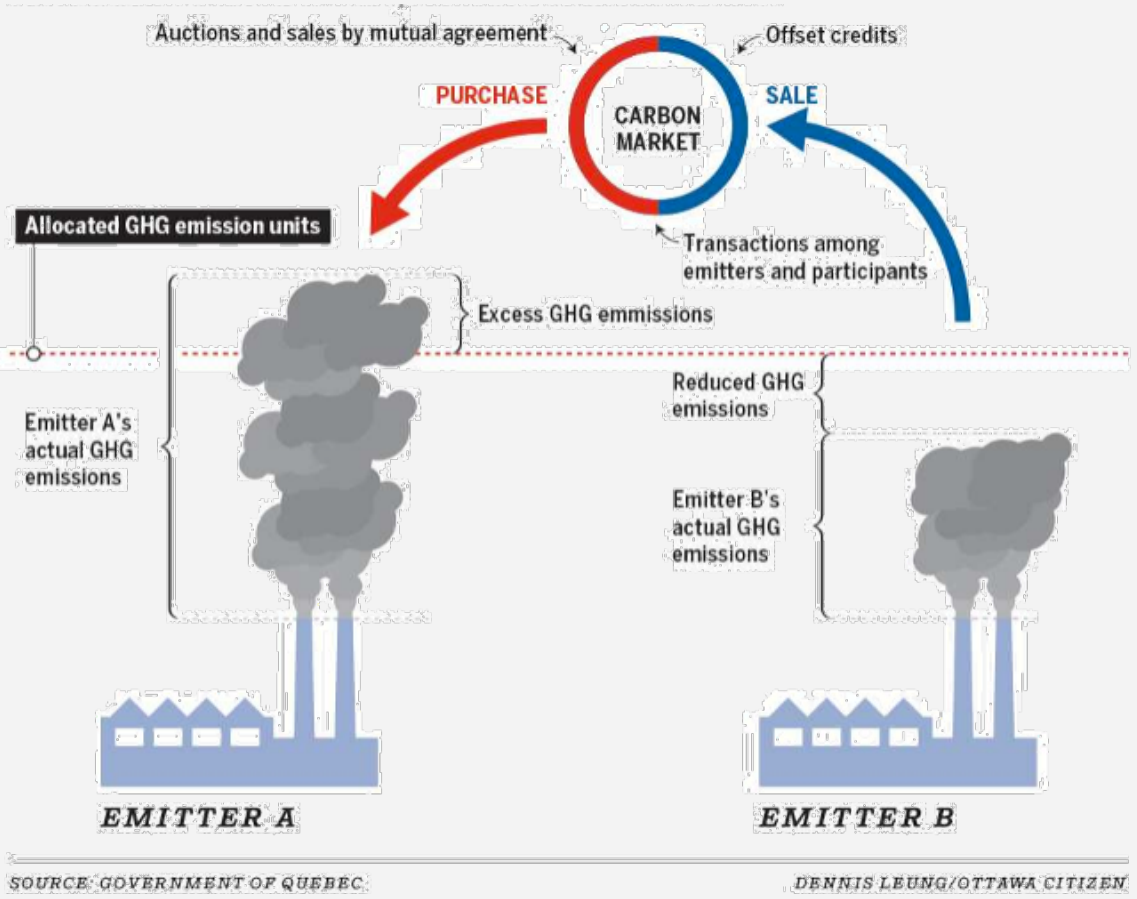
Sustainable development

- **Carbon market (ETS)**



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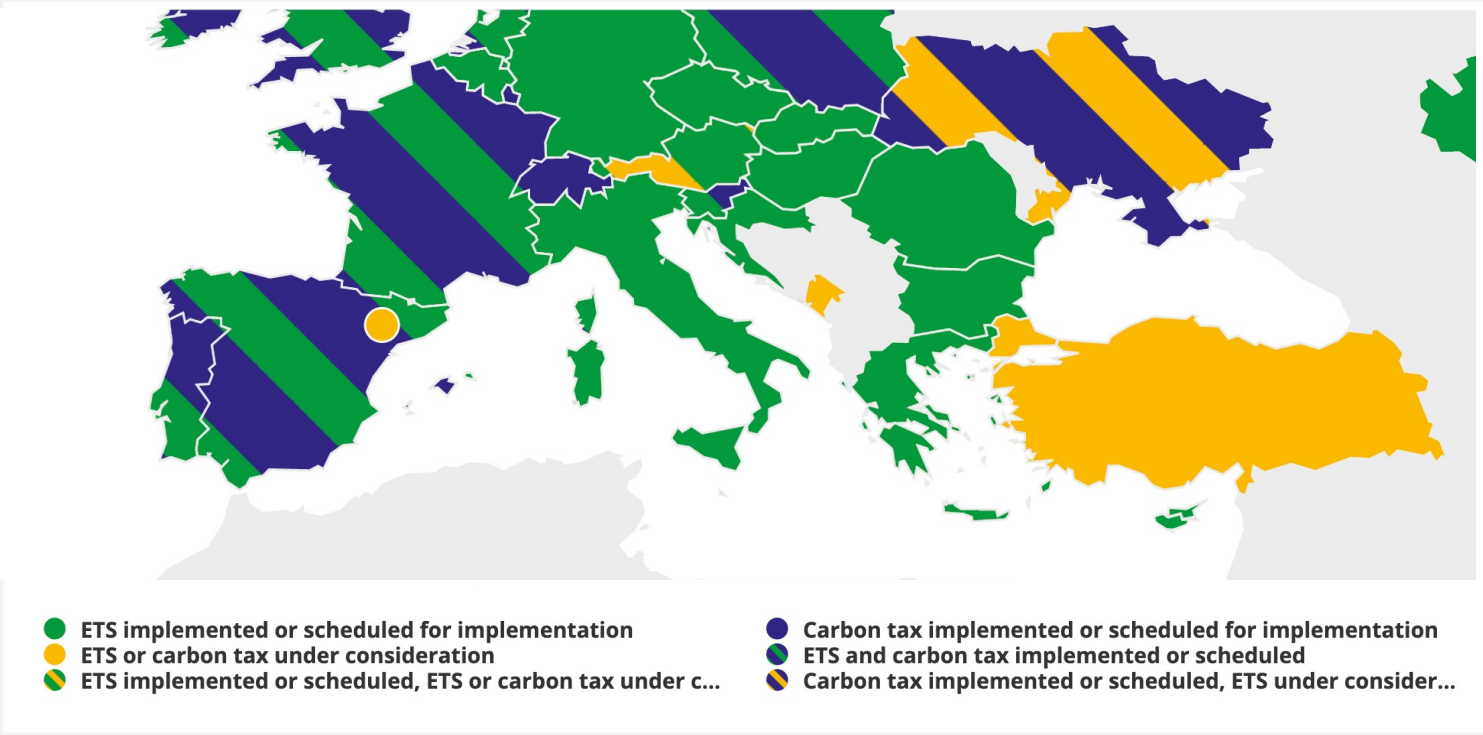
Sustainable development

- **Carbon market (ETS)**

KEY STATISTICS ON REGIONAL, NATIONAL AND SUBNATIONAL CARBON PRICING INITIATIVE(S)

64	Carbon Pricing initiatives implemented
45	National Jurisdictions are covered by the initiatives selected
35	Subnational Jurisdictions are covered by the initiatives selected

In 2021, these initiatives would cover **11.65 $GtCO_2e$**, representing **21.5%** of global GHG emissions



Worldbank.org

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Sustainable development

- **Carbon market (ETS)**

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pilot site of Paimpol-Bréhat (France), DCNS and OpenHydro installed in 2015 two 16-metres tidal turbines on behalf of EDF

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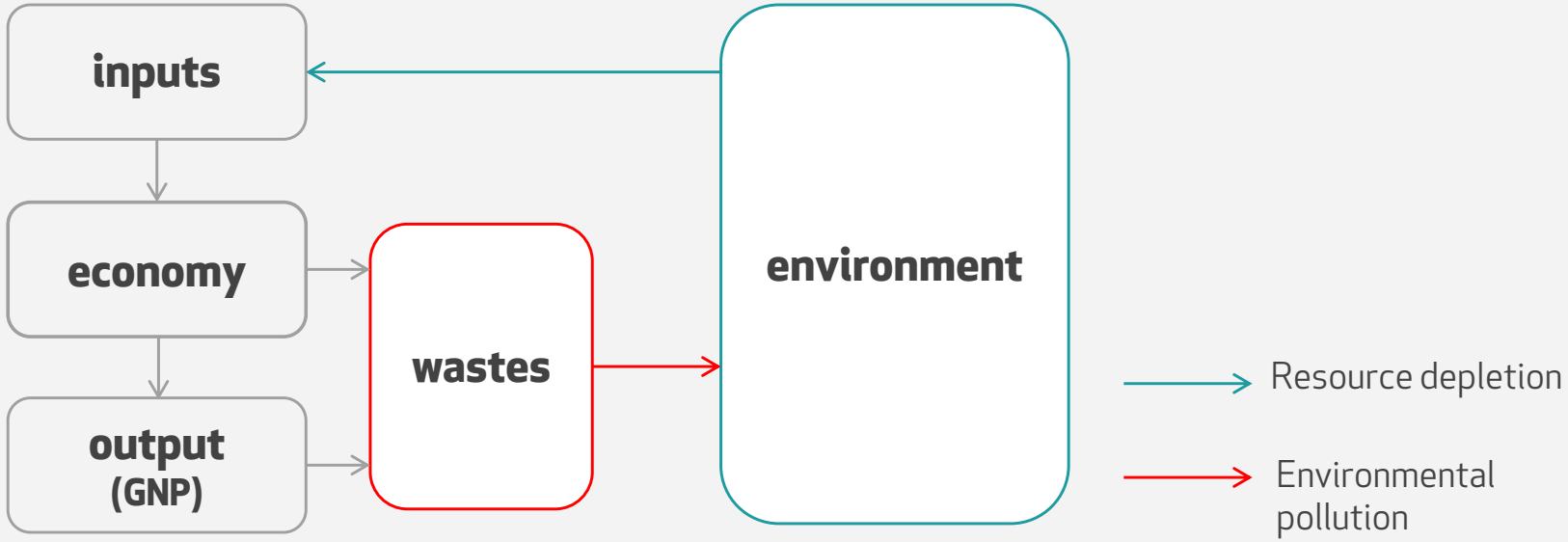
A valuable Environment

- **The Environment is a Resource**
  - Economic & Social developments must be placed in their environmental context (Boulding 1966)
    - « Environmental pollution and the depletion of resources are invariably the ancillaries to economic development »



Adapted from Boulding 1966

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Monetary valuation

- **Benefits we gain from nature**
  - 4 groups
    - **Supporting services**
    - **Provisioning services**
    - **Regulating services**
    - **Cultural services**
  - Barely impossible to quantify entirely
    - 'The total value of biodiversity is infinite, so having debate about what is the total value of nature is actually pointless because we can't live without it'. (Salles 2011)
    - between US$16–54 trillion per year, with an average of US$33 trillion per year (Constanza et al. 1997, Nature)

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Monetary valuation

- **Supporting services**
  - necessary for the production of all other ecosystem services
    - Eg: nutrient recycling, primary production and soil formation.
    - Allow ecosystems to provide food supply, flood regulation, water purification…

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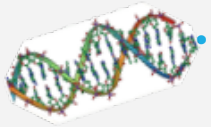
Monetary valuation

- **Provisioning services**
  - Products directly obtained from ecosystems

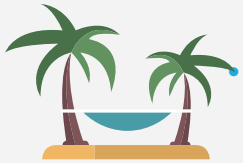
- Food
  - Land and seafood, game, crops, wild foods, and spices

- Raw materials
  - lumber, skins, fuel wood, organic matter, fodder, and fertilizer



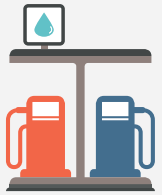
- Genetic resources
  - crop improvement genes, health care

- Water



- Minerals
  - Sand, glass…

- Medicinal resources
  - pharmaceuticals, chemical models, test and assay organisms



- Energy
  - hydropower, biomass fuels

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Monetary valuation

- **Regulating services**
  - Benefits obtained from the regulation of ecosystem processes
  - Carbon sequestration and climate regulation
  - Waste decomposition and detoxification
  - Purification of water and air
  - Pest and disease control

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Monetary valuation

- **Cultural services**
  - Nonmaterial benefits through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences

  - cultural
    - use of nature as motif in books, film, painting, folklore, national symbols, architect, advertising, etc.

  - spiritual and historical
    - use of nature for religious or heritage value or natural

  - recreational experiences
    - ecotourism, outdoor sports, and recreation

  - science and education
    - use of natural systems for school excursions, and scientific discovery

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Monetary valuation

- **Points of view**
  - Avoided cost
    - avoid costs that would have been incurred in the absence of those services
  - Replacement cost
    - could be replaced with man-made systems
  - Factor income
    - enhancement of incomes
  - Travel cost
    - may require travel, whose costs can reflect the implied value of the service

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Waste treatment by wetland habitats avoids health costs

Constructed floating treatment wetland (BioHaven®), Florida

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restoration of the Catskill Watershed
cost less than the construction of a water purification plant
NY state, USA

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improved water quality increases the commercial take of a fishery and improves the income of fishers

Bengladesh, photo WorldFish Center

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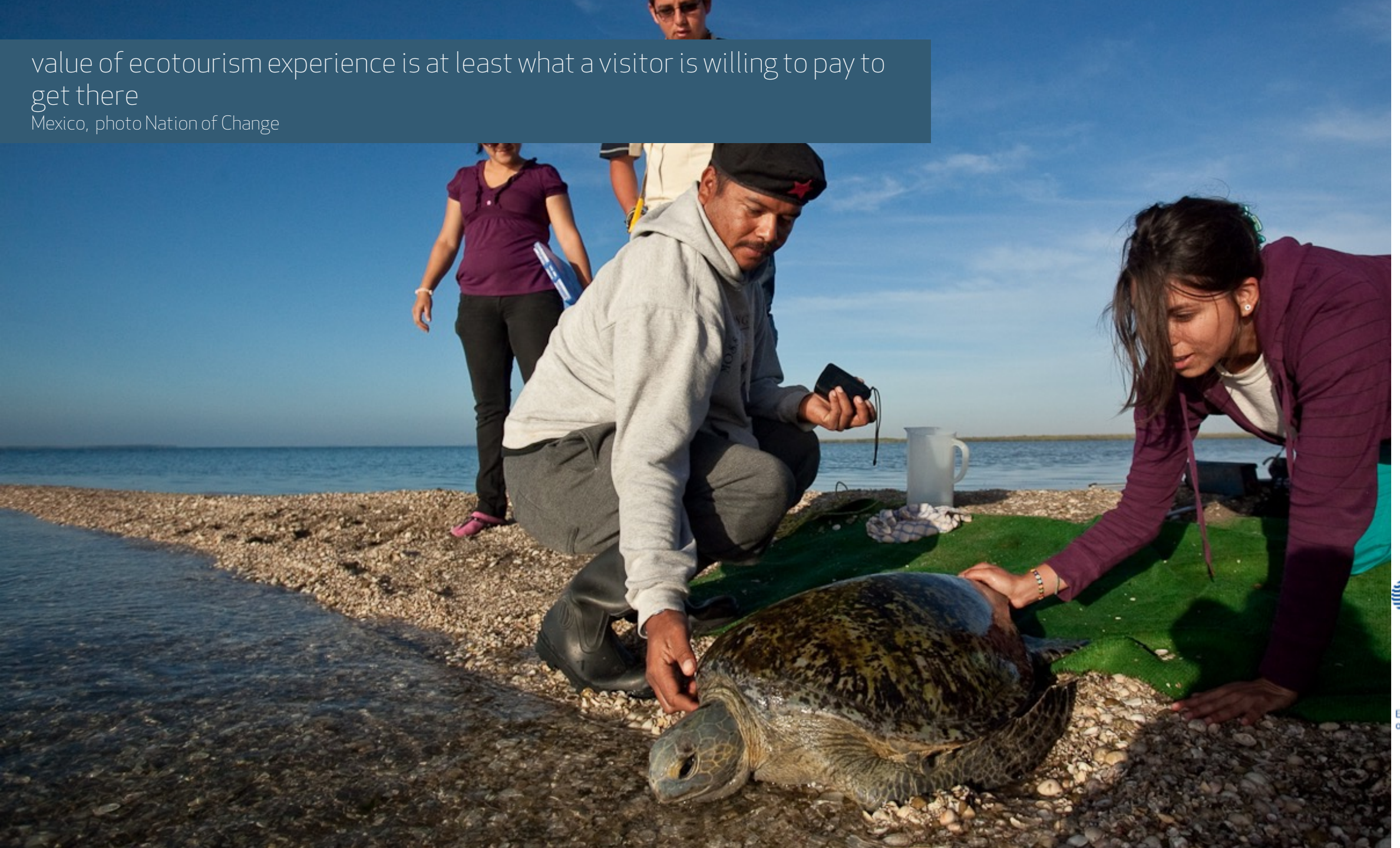

value of ecotourism experience is at least what a visitor is willing to pay to get there

Mexico, photo Nation of Change

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Monetary valuation

- **Points of view (2)**
  - Hedonic pricing
    - may be reflected in the prices people will pay for associated goods
  - Contingent valuation
    - may be elicited by posing hypothetical scenarios that involve some valuation of alternatives

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coastal housing prices exceed that of inland homes

Saint Jean Cap Ferrat, France

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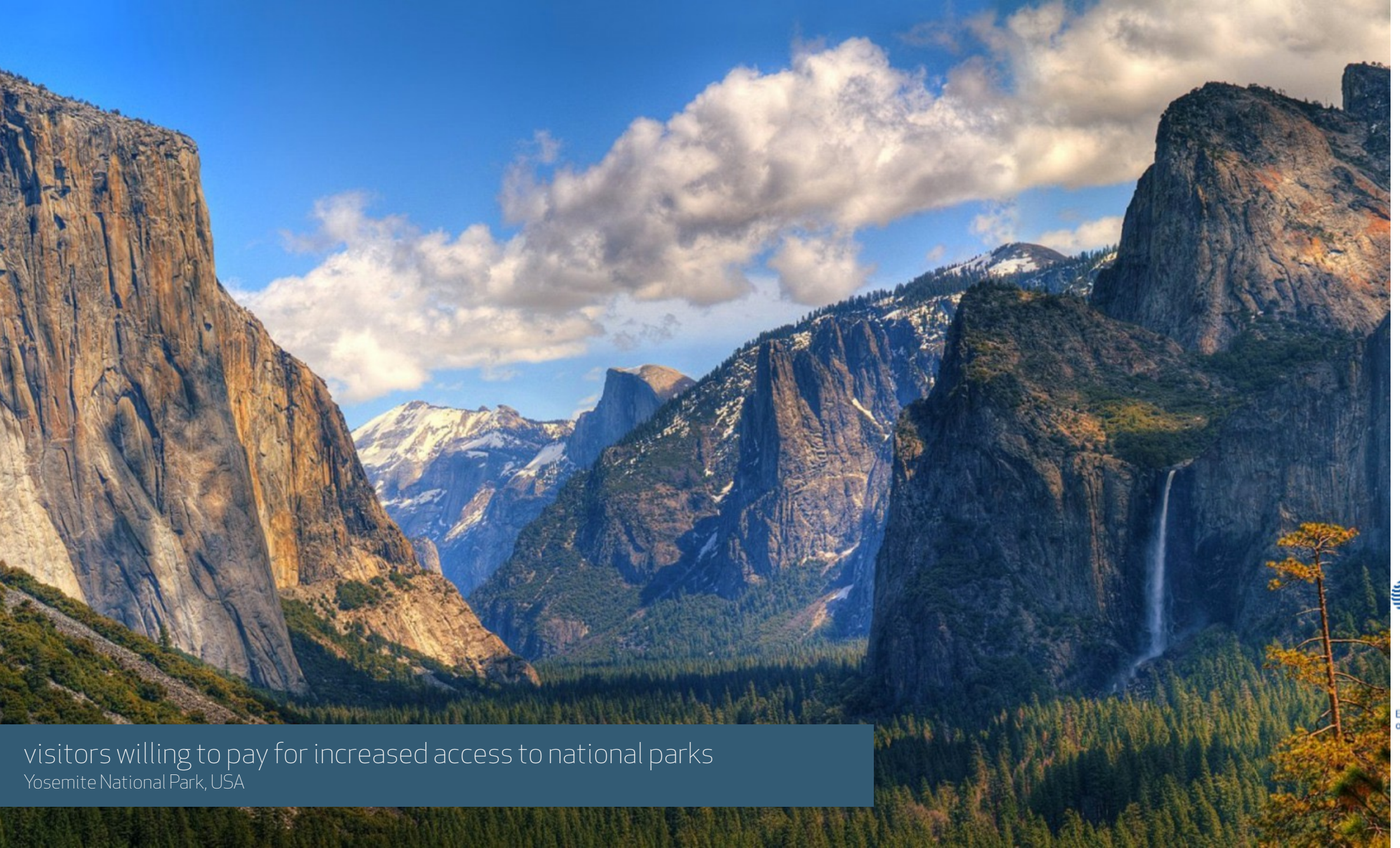

visitors willing to pay for increased access to national parks

Yosemite National Park, USA

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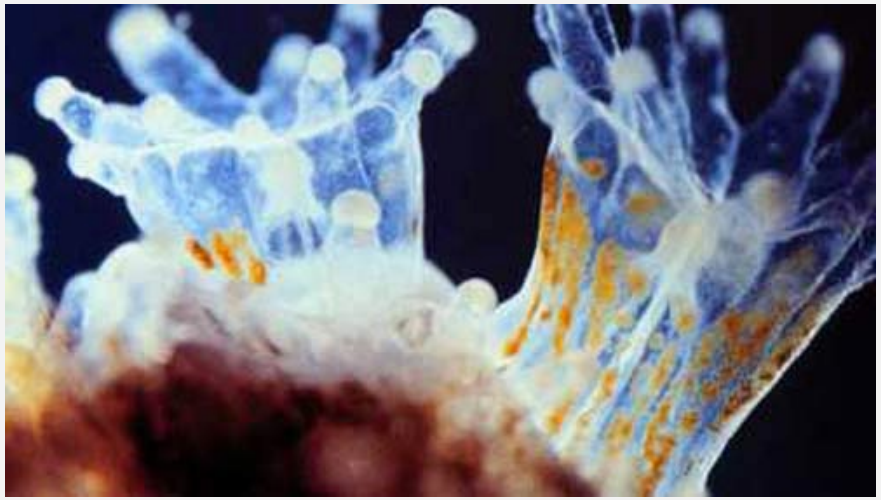
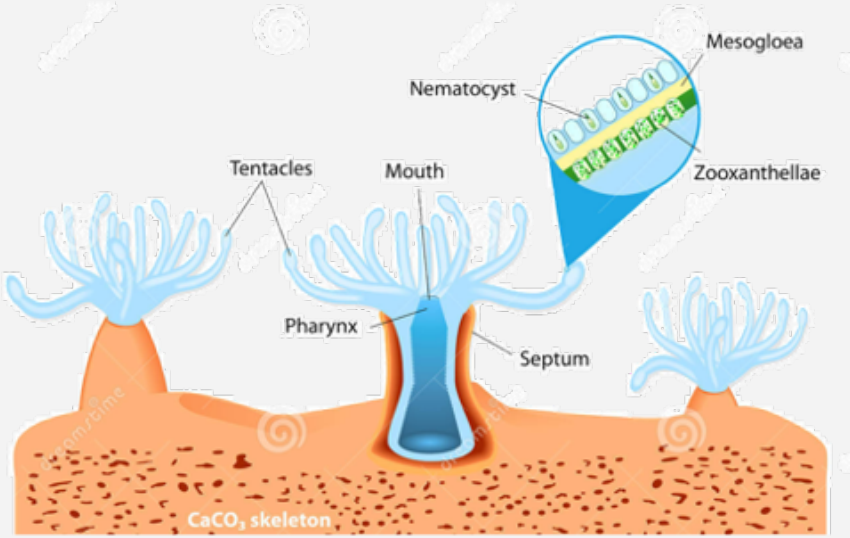
The Coral Reef case study

- **What is Coral?**
  - Symbiotic association with microalgae
  - Coral provides protection
  - Algae provides food and color





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The Coral Reef case study

- **What is Coral?**
  - Require very specific habitats
    - Temperature — relatively warm
    - Salinity — normal levels *(35ppt)*
    - Depth — less than 100-150m *(around 30 feet)*
      - *Light* Algae need light to survive
    - Waves — they like big waves!
      - remove silts + brings more oxygen

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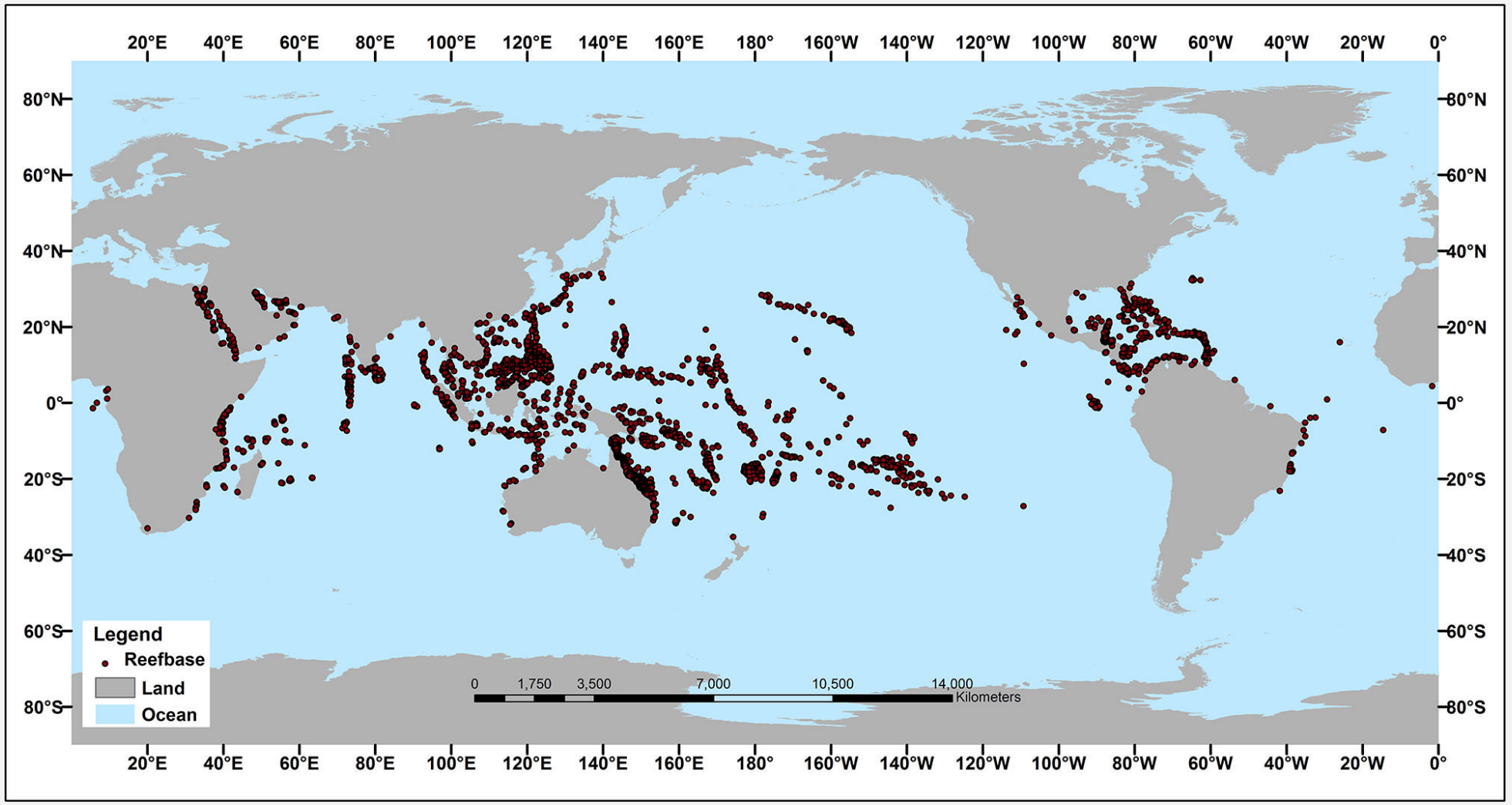
The Coral Reef case study



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The Coral Reef case study

500 000 000+ people rely on coral reefs for food, coastal protection, and livelihoods

Wilkinson, C. (ed.) 2004. Status of Coral Reefs of the World: 2004. Volume 1. Australian Institute of Marine Science. Townsville, Queensland, Australia. 301 p.

More than **150,000** km of shoreline in **100** countries and territories receive some protection from

Burke, L., K. Reytar, M. Spalding, and A. Perry. 2011. Reefs at Risk Revisited. Washington, D.C., World Resources Institute (WRI), The Nature Conservancy, WorldFish Center, International Coral Reef Action Network, UNEP World Conservation Monitoring Centre and Global Coral Reef Monitoring Network,

850 000 000 people live within 100 km of coral reefs.

Burke, L., K. Reytar, M. Spalding, and A. Perry. 2011. Reefs at Risk Revisited. Washington, D.C., World Resources Institute (WRI), The Nature Conservancy, WorldFish Center, International Coral Reef Action Network, UNEP World Conservation Monitoring Centre and Global Coral Reef Monitoring Network, 114p.

In developing countries, coral reefs contribute about **1/4** of the total fish catch, providing food to an estimated **1 000 000 000** people in Asia alone

Moore, F. and B. Best. 2001. Coral Reef Crisis: Causes and Consequences. In: Papers Presented at a Symposium held at the 2001 Annual Meeting of the American Association for the Advancement of Science.

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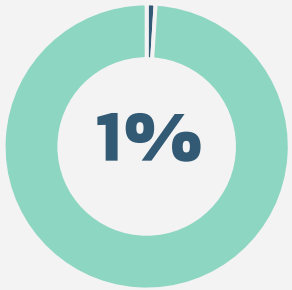
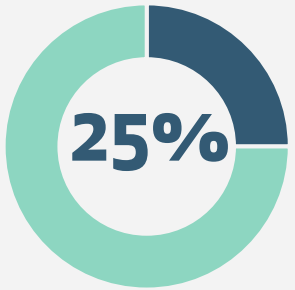
The Coral Reef case study

- **Biodiversity hotspot**



of the ocean is covered by coral reefs



of all marine fish species live in coral reefs

Burke, L., D. Bryant, J. McManus, and M. Spalding. 2008 Reefs at Risk. World Resources Institute (WRI):

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The Coral Reef case study

- **Protection to coastline**

- **absorb energy of ocean waves**
- **reduce erosion of shoreline**
- **reduce storm damage**
- **reduce flooding**

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The Coral Reef case study

- **Fisheries**

- **Food**
  Industrial, artisanal, subsistence
- **Ornamental**
- **Game**

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The Coral Reef case study

- **Tourism & Recreation**

- **Cultural service**
- **Millions of divers and tourists per year**

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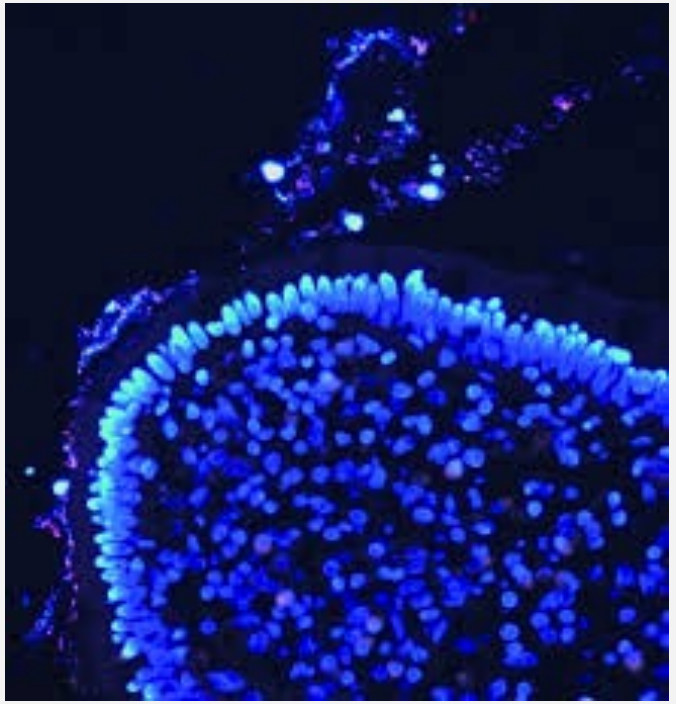
The Coral Reef case study

- **Biotechnology**

- **Bioprospecting**
- **Coral reef is the medicine cabinet of the 21th century**



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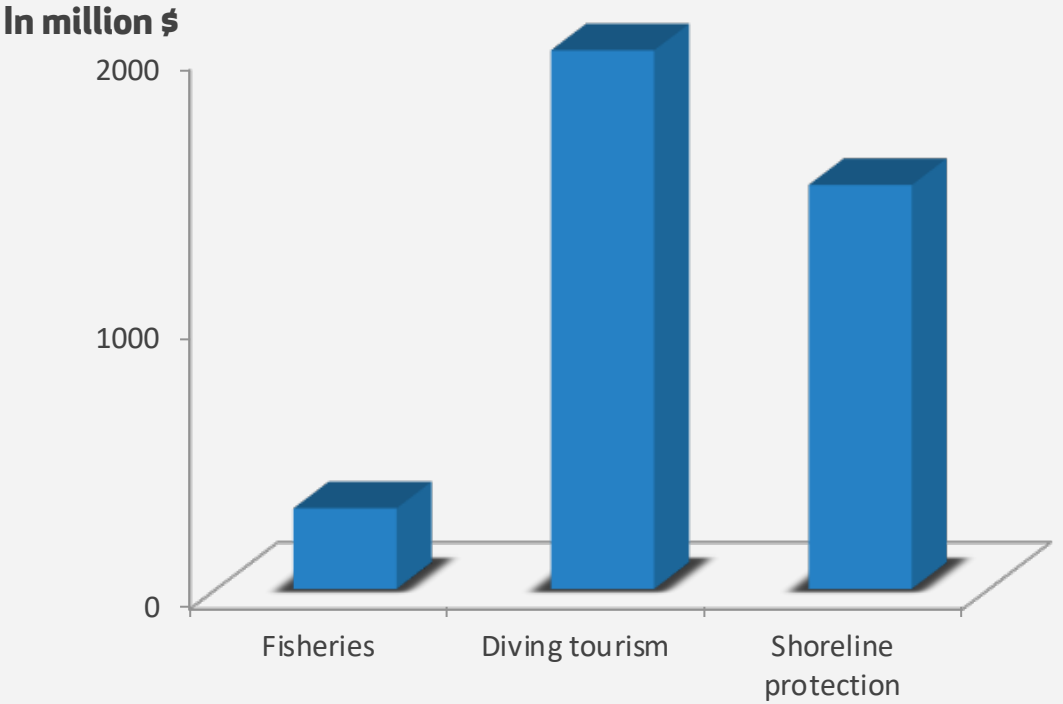
The Coral Reef case study

- **Economic resource**



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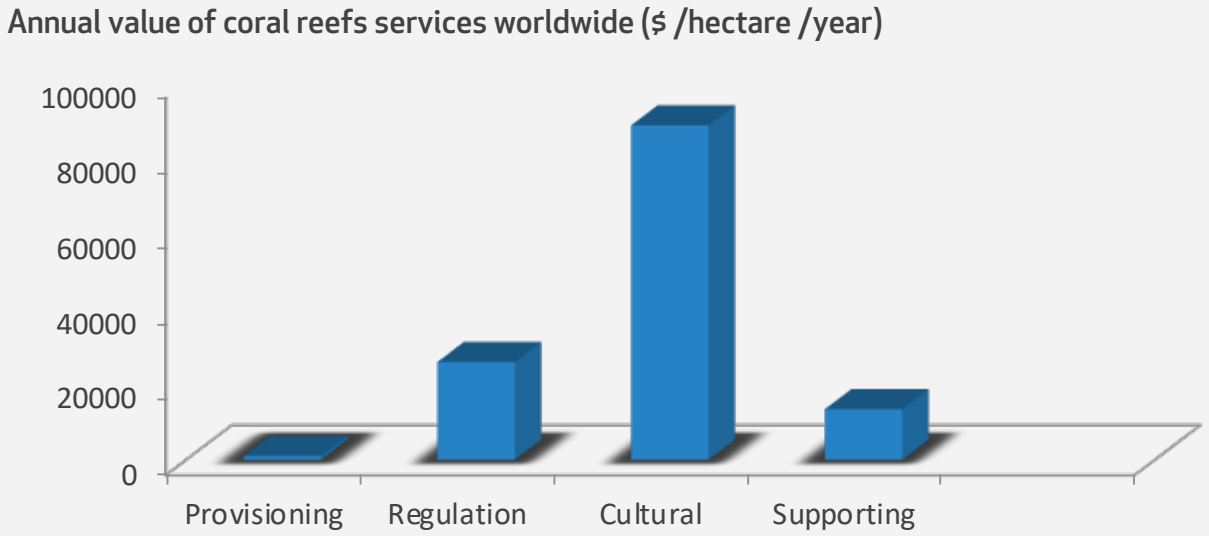
The Coral Reef case study

- **Economic resource**

$ 130,000 per hectare average worldwide (up to $ 1.2 million)

Conservation International. 2008. Economic Values of Coral Reefs, Mangroves, and Seagrasses: A Global Compilation. Center for Applied Biodiversity Science, Conservation International, Arlington, VA, USA



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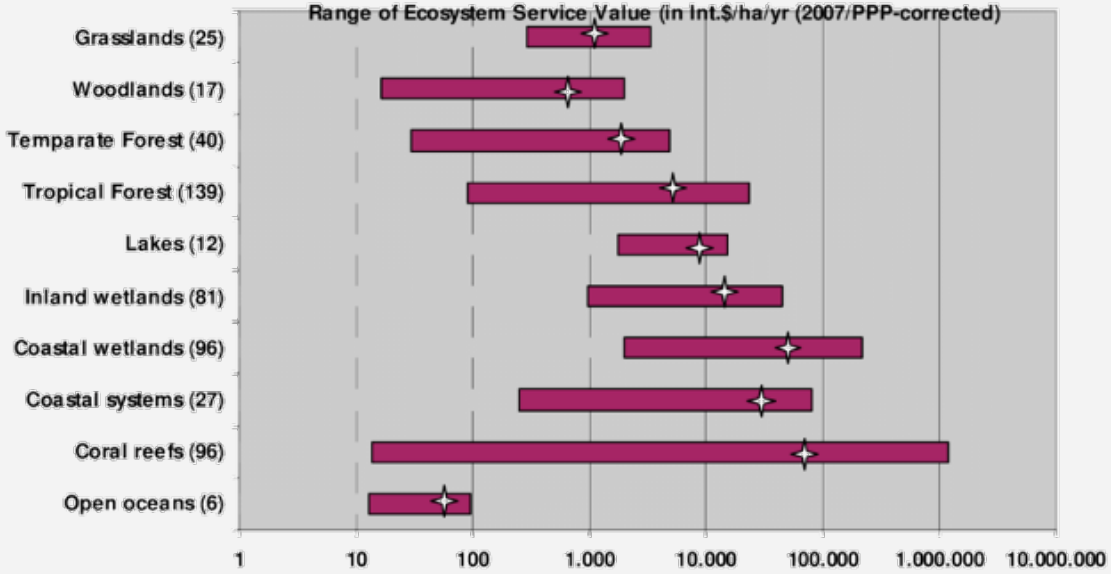

From Ploeg, Sander & Groot, Dolf & Wang, Yafei. (2010). The TEEB Valuation Database: overview of structure, data and results.

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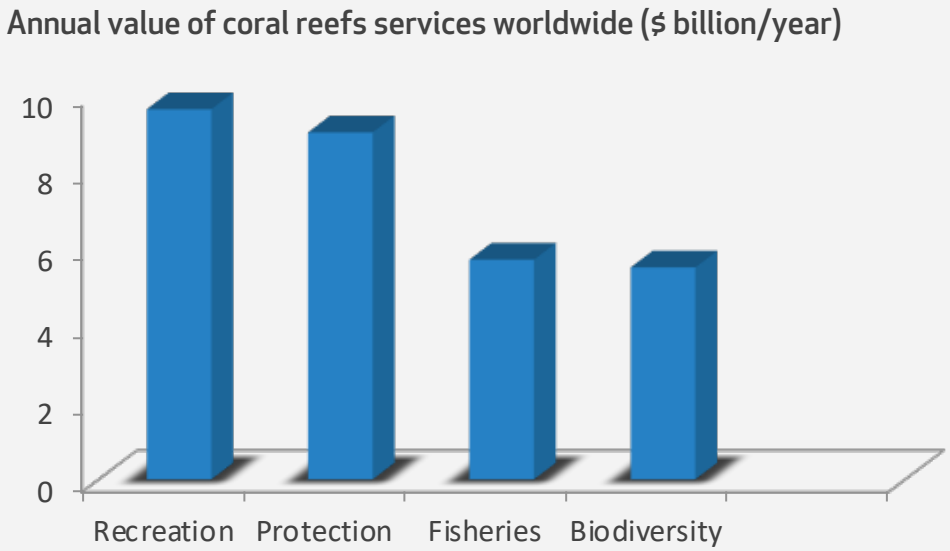
The Coral Reef case study

- **Economic resource**

$30 billion per year net benefice worldwide

Diversitas. "What Are Coral Reef Services Worth? $130,000 To $1.2 Million Per Hectare, Per Year." ScienceDaily. ScienceDaily, 28 October 2009



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